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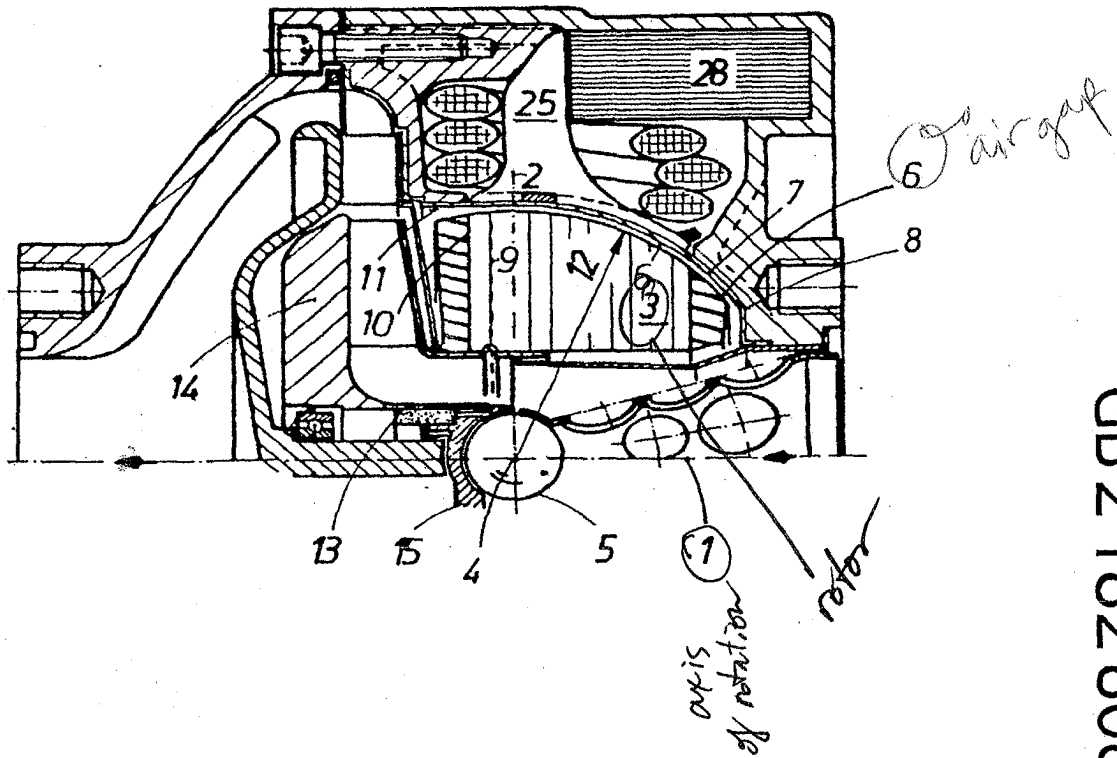
(54) Electric motor having a spherical gap

(57) An electric motor having a spherical rotor (3) which extends axially at both ends beyond the central plane (2), whereby the output may be increased for a given diameter.

Fig. 1



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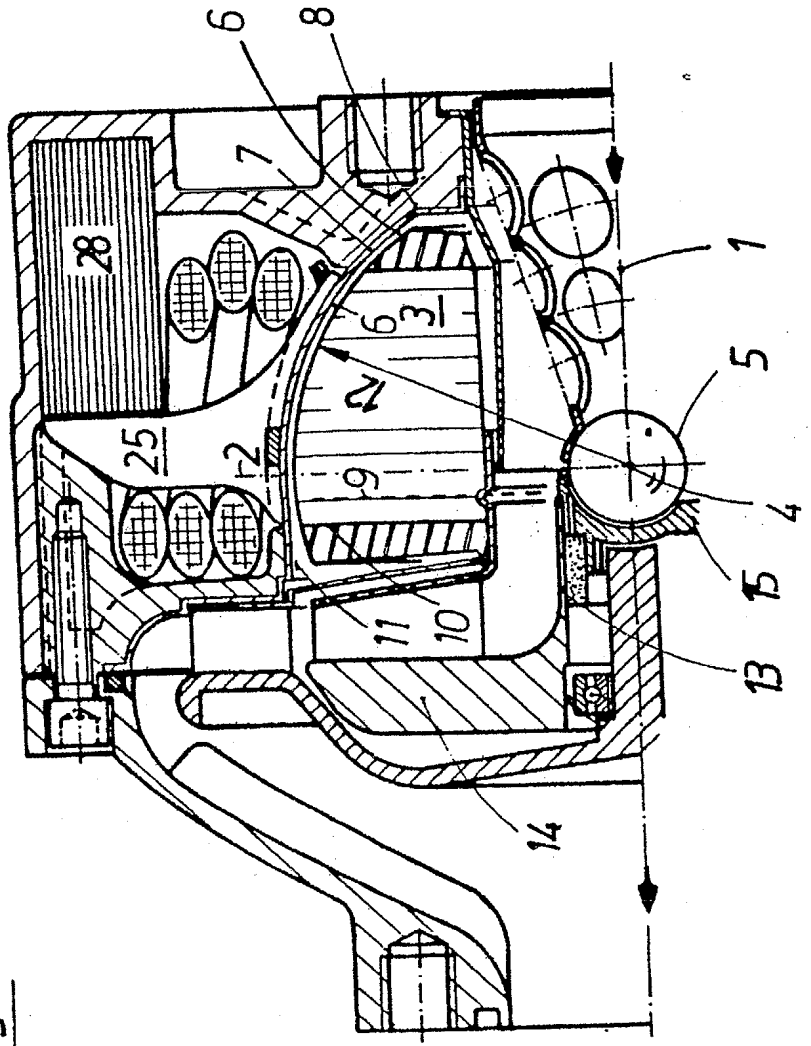

Fig.1

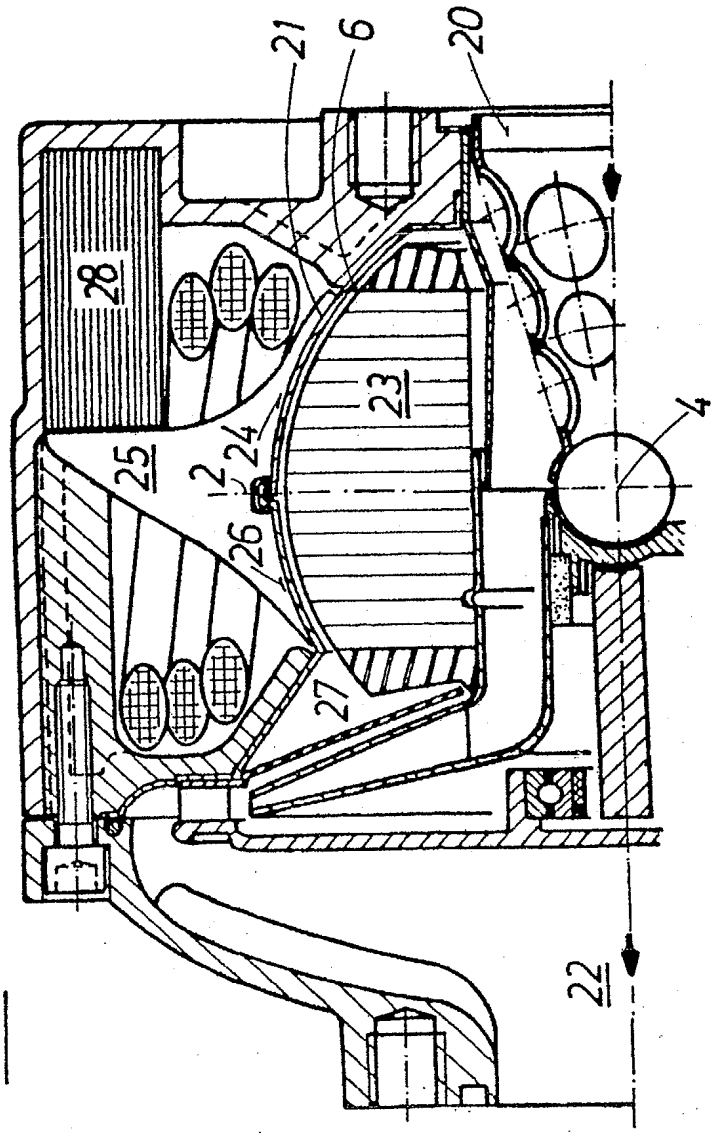

Fig.2

SPECIFICATION

Electric motor having a spherical gap

Electric motors in which the airgap between the rotor and the stator runs along a spherical surface, are increasing in importance. Motors of that kind are constructed with rotors which form geometrically hemispherical sections. Since the stator exerts upon the rotor forces which are effective not only in the circumferential direction but are also directed axially, considerable axial forces have to be taken up by the bearing. This is one of the considerable disadvantages which stand in the way of the broadening of the new generation of motors.

The invention eliminates this disadvantage. In accordance with the invention the rotor is made as a section of a sphere in which the diameter of the sphere no longer coincides with the one axial end of the rotor but lies between the two axial ends of the rotor. Moreover the stator follows this contour only as far as that plane of rotation of the rotor the diameter of which corresponds with the diameter of the sphere minus twice the amount of the airgap. In the part of the stator extending beyond, its boundary runs cylindrically with respect to the rotor, the inner diameter of the cylinder corresponding with the diameter of the rotor.

In a variant upon the invention the stator follows the contour of the rotor as far as both axial ends of it. But the stator then has a divided execution and can only be assembled after introduction of the rotor.

The invention is to be described with the aid of Figures.

Figure 1 – shows a spherical motor in accordance with the invention, which forms one unit with a centrifugal pump and has a removable rotor; and

Figure 2 – shows a variant upon the motor in which the rotor is trapped in both axial directions by re-entrant regions of the stator.

In Fig. 1 a section through the axis of rotation (1) is shown, of one half of a motor in which the motor forms one unit with a centrifugal pump. The greatest diameter of the rotor (3) referred to the axis of rotation (1) lies in the plane of rotation (2) in which the centre (4) of the bearing ball (5) lies too. The dividing wall (7) lying in the airgap (6) to separate the stator and rotor runs along the arc between the planes of rotation (8) and (9) along a surface of a sphere, whilst the dividing wall (7) between the planes of rotation (9) and (10) and also in the region (11) following them runs cylindrically. The inner diameter of the dividing wall (7) coincides with the diameter (12) of the sphere. The rotor (3) can thereby be mounted coming from the left. The bearing on the stationary ball (5) is effected through the hub region (13) of the impeller (14) in which a step bearing (15) is mounted.

Fig. 2 shows an arrangement in which the dividing wall consists of the part (21) next the inlet side (20) and the part (27) next the pump side (22). Through the symmetrical distribution of flux no magnetic axial force becomes effective outwards upon the rotor (23) since the flux through the region (24) of the tooth (25) exactly corresponds with the flux in the region (26).

CLAIMS

1. An electric motor having a gap for the magnetic flux of a predetermined gap width between the stator and the rotor and running along a spherical surface, characterized in that the magnetically effective surface of the rotor (3, 23) lies on a section of a sphere which referred to the plane of rotation lying in the centre (4) of the sphere extends in both axial directions.

2. An electric motor as in Claim 1, having a rotor which forms a section of a sphere and exhibits a first axial end having a greater diameter and a second having a smaller diameter, characterized in that the gap (6) for the magnetic flux is bounded towards the inside by the magnetically effective surface of the rotor (3) and towards the outside by the stator (25, 28) which follows the spherical surface of the rotor (3) at a clearance corresponding with the gap width of the gap (6) for the magnetic flux, the greatest inner clearance from the axis of rotation (1) lying in the plane of rotation (2) lying at the centre (4) of the sphere, and the clearance of the inner surface of the stator tapering again towards the first axial end of the rotor (3) down to a value which is less by twice the gap width of the gap for the magnetic flux than the clearance in the plane of rotation (2).

3. An electric motor as in Claim 1 or 2, characterized in that the inner boundary of the stator at the side next the first axial end of the rotor (3) continues into a cylindrical region (9, 10, 11).

4. An electric motor as in Claim 1, characterized in that the rotor (23) is enclosed by the stator (25).

5. An electric motor as in Claim 4, characterized in that in the gap for the magnetic flux a separating cup is arranged, which consists of two parts (21) and (27) which are connected together on the plane of rotation containing the centre of the sphere.

Amendments to the claims have been filed, and have the following effect:–

*(a) Claims 1, 2 and 4 above have been deleted or textually amended.

*(b) New or textually amended claims have been filed as follows:–

CLAIMS

1. A pump unit comprising a centrifugal pump which has an impeller and which is inte-

gral with an induction motor whose stator is outside the pump chamber and whose rotor is inside the pump chamber and integral with the impeller, a dividing wall being provided between the stator and the rotor, the dividing wall extending along a spherical surface and having a larger diameter at the end facing the impeller than at the opposite end, the stator having a winding through which magnetically conductive teeth which are distributed over the circumference project and which define the conductive path for the magnetic flux between the rotor and a magnetic yoke, characterized in that the winding is arranged around the dividing wall (8), that the teeth (25) project through the winding, that at their inwardly directed boundary the teeth (25) extend over the entire axial length of the magnetically active part of the the rotor (23), and that, as viewed from the centre of the sphere (4), the rotor (23) extends in the direction of both axial ends.

2. For a pump unit according to Claim 1, an electric motor having a rotor which defines a section of a sphere and has a first axial end having a larger diameter and a second axial end having a smaller diameter, the motor being characterized in that the gap (6) for the magnetic flux is bounded inwardly by the magnetically effective surface of the rotor (3) and outwardly by the stator (25, 28) which follows the spherical surface of the rotor (3) at a clearance corresponding to the width of the gap (6) for the magnetic flux, the greatest inner clearance from the axis of rotation (1) lying in the plane of rotation (2) containing the centre (4) of the sphere, and the clearance of the inner surface of the stator tapering again towards the first axial end of the rotor (3) down to a value which is less by twice the width of the gap for the magnetic flux than the clearance in the plane of rotation (2).

4. For a pump unit according to Claim 1, an electric motor which is characterized in that the rotor (23) in enclosed by the teeth of the stator (25).

6. A pump unit according to Claim 1 and constructed, arranged and adapted to operate substantially as hereinbefore described with reference to, and as illustrated in, Fig. 1 or Fig. 2 of the accompanying diagrammatic drawings.

7. An electric motor according to Claim 2 and constructed, arranged and adapted to operate substantially as hereinbefore described with reference to, and as illustrated in, Fig. 1 or Fig. 2 of the accompanying diagrammatic drawings.

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